CONFECTIONERY PRODUCT

BACKGROUND ART

This invention relates to confectionery products based on one or more sugar alcohols, wherein the products have improved transparency.

So-called hard candy or high boiled sweets are common confectionery components and confectionery products may be made wholly or partly therefrom. Hard candy is a solid, glassy or amorphous material made traditionally from sugars (such as sucrose and glucose syrup) although it is also known that these can be replaced wholly or partially by sugar substitutes, in particular sugar alcohols. Suitable sugar alcohols are available commercially and are generally good sweeteners but without the same calorie content as sugars. Accordingly, they can contribute to reducing the calorie content of confectionery products. Inportantly, they also have a well recognized beneficial effect in the reduction of tooth decay since they are resistant to being metabolized by oral bacteria which break down sugars and starches to produce the acids responsible for tooth decay.

As well as being used to make up the whole of confectionery products (boiled sweets), hard candy can also be used as one component of confectionery products, for example, an outer casing. Products are well known which comprise a solid, for example powder, or liquid core surrounded by a casing of hard candy.

Hard candy is generally made by a process in which a mixture of the sugar or sugar alcohol and water is heated, generally under vacuum, at a temperature of about 130-150°C. The resulting mixture can still be worked and formed into confectionery products as desired and on cooling forms a glassy amorphous solid with a water content of less than 3%. Hard candy generally contains other ingredients some of which are acidic. Sugar alcohols which are not monosaccharide sugar alcohols show some susceptibility to acid hydrolysis, and so acid components are conventionally added towards the end of the heat treatment. However, hydrolysis of the sugar alcohol can still occur which in turn results in a sticky, hygroscopic product and/or crystallisation of the candy. In addition, by the time that the acid component is added, the water content of the mixture has been reduced, generally to around 2% or less. The acids are conventionally added as powder rather than pre-dissolved in water to avoid introducing additional water which would remain in the final composition, possibly with detrimental effects on the quality of the final product, but this has the consequence that

dissolution of the acid may be difficult or incomplete. As a result of these factors, there is a tendency of the hard candy to be opaque.

One example of a commercially available sugar alcohol commonly used as a sugar substitute is Isomalt which is made by enzymatic rearrangement of sucrose followed by hydrogenation. Isomalt is a mixture of the isomers 1-O-α-D-glucopyranosyl-D-mannitol dihydrate and 6-O-α-D-glucopyranosyl-D-sorbitol. Further information concerning Isomalt can be found in the publication LFRA Ingredients Handbook, Sweeteners, Edited by Janet M Dalzell, published by Leatherhead Food RA, December 1996, pages 21 to 44. This publication describes the processing of Isomalt into hard candy and shows flavor, color and citric acid being added at the cooling stage of the process after cooking is complete (Figure 11, page 44).

US patent 3,738,845 relates to a process for the preparation of clear sorbitol hard candies confections which prevents the crystallization of sorbitol by addition of an organic acid, prior to the completion of the cooking step, which is carried out to a temperature of at least 300°F (about 149°C).

European patent application 1,151,672 relates to a confectionery product comprising a filling enclosed within a casing. The filling comprises a major amount of a monosaccharide polyol in a crystalline anhydrous powder form chosen from among polyols having as cooling effect. The casing is a protective confectionery material such as hard candy.

European patent application 1,151,673 relates to a confectionery product comprising at least one functional ingredient wherein it has a casing and a filling enclosed within the casing. The filling comprises at least one confectionery material having properties that confer to the filling a perceivable effect when the filling is released in the mouth. The casing, which may be hard candy, is capable of providing release means upon the action of saliva in the mouth which acts to liberate the filling out of the casing to be left substantially as an empty shell before it has entirely dissolved in the mouth.

While these products are useful, it is often desirable for aesthetic reasons for hard candy to be as transparent as possible. Accordingly, the present invention now satisfiies this desire and need.

SUMMARY OF THE INVENTION

The present invention now provides hard candy containing at least one acidic component which shows improved transparency.

According to one aspect, the present invention provides a method for the manufacture of a glassy amorphous solid as a confectionery material, wherein the glassy amorphous solid comprising at least one acidic component and at least one sugar alcohol which is not a monosaccharide sugar alcohol. The method comprises the steps of:

(i) forming a liquid starting material comprising water, the at least one acidic component, and the at least one sugar alcohol which is not a monosaccharide sugar alcohol;

(ii) evaporating water from the liquid starting material under conditions at which the acidic component does not cause significant hydrolysis of the sugar alcohol to dissolve the acidic component in the liquid and to remove at least part of the water to form an intermediate material; and

(iii) cooling the intermediate material to form a glassy amorphous solid that has improved transparency compared to a glassy amorphous solid that does not contain an acid.

Advantageously, the method further comprises applying a vacuum to assist in removing water to reach a desired final water content of the intermediate material. Preferably a vacuum evaporator is used to apply vacuum and remove at least some water. The evaporating can be conducted in multiple stages if desired, with a reduced pressure being applied in some or all of the stages. The liquid starting material can be fed to an evaporator at a temperature of about 115-125°C where water is removed without application of a vacuum to form a partially dehydrated mass which is then fed to the vacuum evaporator under vacuum at a temperature of 135-140°C where further water is removed down to reach the final water content of the intermediate material. A final water content that is reduced to below 3% is highly desired.

The invention also relates to a confectionery product at least a part of which is a glassy amorphous solid comprising one or more sugar alcohols and at least one acidic component. This glassy amorphous solid has an improved transparency compared to a glassy amorphous solid that does not contain an acid, as evidenced by a transmission of at least 47.8% at 450nm; and/or at least 50.9% at 550nm; and/or at least 52.3% at 650nm.

The confectionery product can be in the form of a two part product with a liquid or powder filling encased in a shell of the glassy amorphous solid. A preferred filling is based on a polyol such as xylitol which has a cooling effect when the filling is delivered in the mouth. The filling can contain one or more active ingredients selected from vitamins, oligosaccharides, camomile, lemon balm and menthol.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated by the following non-limiting examples in which reference is made to the accompanying drawings, in which:

Figure 1 shows the mounting apparatus used for the samples in Example 3;

Figure 2 illustrates the theory of the method of example 3; and

Figure 3 is a graphical representation of the results of Example 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The glassy amorphous solid will be referred to hereinafter as hard candy. It has surprisingly been found that acidic component(s) which have conventionally been found to hydrolyse the sugar alcohol can be added from the start of the process for the manufacture of hard candy provided that conditions are used in the process under which the acid does not hydrolyse the sugar alcohol. Generally this will involve the use of a vacuum evaporator to reach the desired final moisture content at a temperature which is low enough to avoid hydrolysis of the sugar alcohol. As a result the problems referred to above are alleviated and the hard candy shows improved transparency.

Preferably, the evaporation is carried out at a temperature not exceeding 148°C, more preferably, not exceeding 145°C.

The sugar alcohol may be any of the commercially available non-monosaccharide sugar alcohols intended for use in confectionery products and suitable for the production of non-hygroscopic hard candy. Suitable sugar alcohols include isomalt, maltitol, lactitol, polydextrose and combinations thereof. The sugar alcohol is preferably used as the basis of the hard candy without addition of sucrose. If desired the hard candy may be based on a mixture of sugar alcohol and sucrose but in this case some or all of the advantages of using sugar alcohols instead of sucrose may be lost.

According to a preferred embodiment of the invention, the sugar alcohol is isomalt which may optionally be used with an addition of from 1 to 20% of maltitol syrup such as that produced by hydrogenation of a high maltose glucose syrup. An example of such a syrup is Lycasin produced by Roquette Freres. The syrup used as starting material for hydrogenation may be obtained by controlled enzymatic hydrolysis of purified starch and, in addition to maltose, contains higher molecular weight saccharides which influence the properties of the final maltitol syrup. When used with isomalt, the maltitol syrup acts as an

anti-crystallising agent to inhibit isomalt crystallisation and excessive brittleness and fragility of the hard candy.

The hard candy also includes one or more acids. The acid should be stable to the temperatures used in production of the hard candy and is generally present as a flavor or flavor enhancer. The acid may be any edible and food-acceptable acid and examples include one or more of citric, malic, lactic, tartaric and fumaric acids. The acid is generally added as the solid acid in an amount of up to 2%, preferably from 0.3 to 1%. For example citric acid may be added in an amount of about 0.5% and malic acid in an amount of about 0.8%.

The hard candy may also contain other heat stable ingredients. Thus the hard candy may include a high intensity sweetener to enhance the effect of the sugar alcohol and examples of such sweeteners include AcesulfameK and neohespiridin DC. Such intense sweeteners are generally added in conventional amounts to produce the desired level of sweetness, for example 0.05-0.1%.

Other ingredients which may be included are flavorings and colorings which will generally be added in accordance with the manufacturer's recommendations. The hard candy may also include active ingredients such as menthol, vitamins or oligosaccharides in amounts such as to achieve the desired result. These other ingredients may be added to the batch at the start or may be added following cooking depending on the nature of the ingredient.

Hard candy based on sugar alcohols such as isomalt can be produced in the manner generally described for isomalt in LFRA Ingredients Handbook, Sweeteners, Edited by Janet M Dalzell, published by Leatherhead Food RA, December 1996, pages 21 to 44. The ingredients for the hard candy may be mixed initially to form a basic syrup with water generally at about 70-80% solids, preferably about 75% solids. Care should be taken to dissolve the ingredients as completely as possible and dissolution will generally take place in hot water, for example at around 80 to 100°C. If desired, the sugar alcohol can be dissolved first, followed by addition of other ingredients including the acid only once the sugar alcohol has fully dissolved.

Cooking is carried out at elevated temperature using conditions under which the acid does not cause significant hydrolysis of the sugar alcohol. This will usually involve the use of a multi-stage evaporation process with reduced pressure (at least a partial vacuum) being applied in one or more stages to ensure removal of water to the desired level. Minimising the cooking temperature and cooking time prevents the acid causing significant hydrolysis of the sugar alcohol. Cooking is continued to remove water until the desired water level, generally

below 3%, preferably 2% or less, more preferably 1% or less, has been achieved. A low moisture content prevents stickiness and re-crystallisation of the hard candy.

Dissolution of the sugar alcohol and addition of other ingredients is generally carried out batchwise, for example in an open kettle with agitation, to form the basic syrup with a temperature of, for example 80°C. Cooking may be carried out in batches or continuously but continuous production using conventional cooking apparatus is preferred for commercial scale production. For example, basic syrup at 80°C can be heated in an evaporator at about 115-125°C where water is removed without application of a vacuum. The partially dehydrated mass is then fed to a second evaporator under vacuum at 135-140°C where the remainder of the water is removed down to the desired water content. Following cooking the mass is cooled, for example by depositing on a cooling wheel or table.

According to one preferred embodiment of the invention, the hard candy is used to make a two part confectionery product with a liquid or powder filling encased in a shell of the hard candy. Examples of such products are the confectionery products disclosed in European patent applications 1,151,672 and 1,151,673 referred to above. The filling may be based on a polyol such as xylitol which has a cooling effect when the filling is delivered in the mouth. The filling may contain an active ingredient such as one or more vitamins (e.g vitamin C or vitamin E), oligosaccharides, camomile, lemon balm or menthol. For further discussion of active ingredients which may be incorporated into the filling reference is made to European patent application 1,151,673, paragraphs [0033] – [0049].

Prior to final solidification, the hard candy may be converted into confectionery products such as those referred to above using the methods as described in European patent applications 1,151,672 and 1,151,673.

Enhanced transparency in the hard candy is a generally desirable property on aesthetic grounds but is particularly desirable in the context of two part confectionery products as referred to above.

Transparency can be measured on a sample of the solid hard candy of standard thickness by a method in which percent transmission is measured spectrophotometrically over a range of wavelengths, for example 400 to 700nm. For example, a section from the product can be mounted in a holder and placed against a standard background card with black and white areas. Light from a spectrometer, such as an X-Rite SP68 Spectrometer, is passed through the central area of the sample. The energy reflected by the sample is recorded over

the standard black background and the standard white background which allows percentage transmission to be calculated. Such a method is described in more detail in Example 3 below.

Transmission for a hard candy prepared according to the invention has been found to be consistently greater than with a comparable product made by a method using higher temperature with addition of acidic ingredients during cooling.

According to another aspect, the present invention provides a confectionery product at least a part of which is a glassy amorphous solid comprising one or more sugar alcohols and at least one acidic component, the said glassy amorphous solid having a transmission of:

at least 47.8% at 450nm; and/or

at least 50.9% at 550nm; and/or

at least 52.3% at 650nm.

It should be noted that transmission as measured at a particular wavelength may be affected by factors other than the inherent transparency of the hard candy and one such factor is the absorption of any dye which may have been added to the formulation to produce a colored confectionery product. In the case of a colorless product, i.e. hard candy to which no dye has been added, it is likely that the product will have transmission of at least the levels stated above at all three wavelengths. Products to which dye has been added may not exhibit the stated minimum transmission levels at all three wavelengths depending on the absorption of the dye but should show the stated minimum transmission level for at least one of the wavelengths.

EXAMPLES

The following examples are provided to illustrate the most preferred embodiments.

Example 1: Product according to the invention

50kg of water at 95°C is added to a stirred jacketed vessel. This is followed by 25kg of maltitol syrup (Lycasin 80/55 from Roquette Freres) and then 125kg Isomalt (Isomalt ST type F from Palatinit Süßungsmittel GmbH). The batch is mixed and heated until the batch reaches a temperature of 80°C. 1kg citric acid (citric acid anhydrous, fine granular 51 N, Roche), 1.4kg malic acid (malic acid Fuso type M, fine granular) and 0.2kg AcesulfameK are added manually to the batch to form a casing premix.

The casing premix is continuously pumped into two evaporators arranged in series. The first stage takes the mass to 120°C at atmospheric pressure and then the second stage

heats the mass to 138°C. The mass enters a flash system where a vacuum (0.5 atm.) is applied to take the mass to a final moisture content of 1.2%.

The resulting cooked mass is cooled down on a table to 70°C. A batch roller equipped with a powder pump is charged with the cooked mass. A filling of 98% xylitol powder (Xylisorb 90 from Roquette Freres), 1% citric acid, 0.2% lemon flavor, 0.8% AcesulfameK is then pumped into the centre of the cooked Isomalt mass within the batch roller and a rope, calibrated in a rope sizer at an external diameter of about 15mm, is pulled into a chain die assembly. The filling pump is calibrated to pump about a 12% of filling part with respect to the casing part. Xylitol filled candies are pressed into round shapes of 2 grams having dimensions of about 11.5 mm height by about 15 mm diameter which are cooled in a cooling tunnel until reaching a temperature of 30°C.

<u>Example 2</u>: Comparison example with addition of acid after cooking

50kg of water at 95°C is added to a stirred jacketed vessel. This is followed by 25kg of maltitol syrup (Lycasin 80/55 from Roquette Freres) and then 125kg Isomalt (Isomalt ST type F from Palatinit Süßungsmittel GmbH). The batch is mixed and heated until the batch reaches a temperature of 110°C. The batch is then passed to an evaporator where it is cooked to 145°C. The mass is then put in batch under a slight vacuum (0.9atm.) for 3 minutes. The cooked mass is then discharged on a cooled table and 1kg citric acid (citric acid anhydrous, fine granular 51 N, Roche), 1.4kg malic acid (malic acid Fuso type M, fine granular) and 0.2kg AcesulfameK are added. The ingredients are mixed until a plastic mass if formed. This mass at 70°C is then introduced into a batch roller equipped with a powder pump.

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<u>Example 3</u>: Measurement of Transmission

Samples of the outer casing of the products produced in Examples 1 and 2 are prepared for optical analysis by mounting them in a metal ring, cutting off the back of the

product flush with the ring and then brushing out the filling powder. Mounting the samples in a ring provides three benefits. Once fixed in the ring, the sample can be more easily handled without touching or damaging the product surface. The position of the ring determines the thickness of the sample which is to be measured so that the average path length of light through all samples can be made approximately the same. The dimensions of each sample relative to the ring can be easily measured using engineering tools such as a digital calliper or a micrometer.

Figure 1 shows a cross-sectional diagram of mounting apparatus for fitting a ring (5) to a sample (4). A sample holder (3) can be positioned at a set height relative to a mounting frame (1) by adjusting a screw (2). The position of the screw is adjusted so that the thickness of the ring mounted sample, after cutting off the back of the sweet, would be 3.7mm from the top centre of the sweet to the back of the metal ring. After positioning, a metal ring (5), pre-heated to approximately 120°C, is pushed down onto the sample with a gloved hand until the ring lies in contact with the metal mounting frame (1). The ring is chosen so as to have an internal diameter only slightly smaller than the sample, so that it grips the edges of the sample tightly without damaging the main body of the sample. As the ring touches the metal mounting frame it cools rapidly and can be handled without gloves.

The ring containing the sample is then gripped in a vice (not shown) and the back of the sweet (6) is carefully sawn off with a fine toothed saw. The powder filling can then be brushed out to leave a sample of the casing material. The cut edge of the sweet casing is then smoothed to be flush with the surface of the ring by gently rubbing the assembly against fine grade abrasive paper.

The sample to be measured is placed on a standard background card and in such a position that the light from an X-Rite SP68 Spectrometer is incident on the central area of the sample. The energy reflected by the sample is recorded with the sample placed over a standard black background card and with the sample placed over a standard white background card. This allows a value for the percentage transmission to be calculated, according to the following method based on a Kubelka-Munk type analysis, often referred to in text books in this area such as "Colour Physics for Industry" ed. R. MacDonald, SDC Press, 1997 pp.292-304.

Analysis Model:

Consider each part of the sample assembly to be represented by a coating layer on a substrate which is the white or black background. The incident energy flux on the coating is I and the energy flux passing from the other direction is J. This is illustrated in Figure 2.

$$\mathrm{R} = \frac{\text{energy flux reflected by the system}}{\text{energy flux incident on the system}}$$

$$\mathrm{R_g} = \frac{\text{energy flux reflected by the substrate}}{\text{energy flux incident on the substrate}}$$

where R_1 and R_{g1} are the above ratios for a white background and R_2 and R_{g2} are for a black background. Accordingly:

$$\mathrm{R_0} = \frac{\text{energy flux reflected by the layer}}{\text{energy flux incident on the layer}}$$

$$T = \frac{\text{energy flux transmitted through the layer}}{\text{energy flux incident on the layer}}$$

$$R_0 = \frac{R_1 R_{g2} - R_2 R_{g1}}{R_{g1} R_{g2}(R_1 - R_2) + (R_{g2} - R_{g1})}$$

$$\mathrm{T} = \sqrt{\frac{(\mathrm{R_1} - \mathrm{R_0})(1 - \mathrm{R_0 R_{g1}})}{\mathrm{R_{g1}}}}$$

Six samples manufactured according to Example 1, and six samples manufactured according to Example 2 were measured and the transmission calculated as above. The transmission values and standard errors are given below in Table 1 and the results are plotted in Figure 3.

Table 1

	Example 1		Example 2	
Wavelength /nm	**T Avg(6) %**	**Std Err(6)**	**T Avg(6) %**	**Std Err(6)**
400	48.17	0.78	45.52	2.61
410	47.88	0.80	45.16	2.34
420	47.04	0.82	44.39	2.23
430	47.12	0.83	44.46	2.15
440	47.76	0.84	45.04	2.11
450	48.43	0.85	45.70	2.11
460	49.18	0.85	46.44	2.12
470	49.64	0.88	46.93	2.12
480	49.97	0.90	47.28	2.10
490	50.30	0.92	47.60	2.09
500	50.63	0.93	47.90	2.08
510	51.04	0.95	48.28	2.08
520	51.40	0.96	48.59	2.07
530	51.65	0.95	48.74	2.05
540	51.83	0.92	48.82	2.03
550	51.90	0.89	48.85	2.02
560	51.94	0.87	48.89	2.02
570	52.04	0.85	49.00	2.01
580	52.12	0.84	49.14	2.01
590	52.14	0.87	49.28	2.02
600	52.18	0.91	49.45	2.03
610	52.28	0.94	49.62	2.03
620	52.43	0.96	49.79	2.01
630	52.61	0.99	49.94	1.98
640	52.82	1.00	50.10	1.96
650	53.07	0.94	50.32	1.94
660	53.28	0.88	50.63	1.96
670	53.36	0.87	51.06	2.05
680	53.39	0.89	51.52	2.13
690	53.40	0.92	51.88	2.15
700	53.39	0.96	52.19	2.13